

# Addressing barriers to large-scale corporate renewable energy procurement in China

March 2022





## **Acknowledgements**

The Carbon Trust would like to thank everyone that has contributed their time, insights and expertise during the preparation and completion of this report. Special thanks go to Mr Conor Gask and Ms Ma Chongxi, whose input was invaluable in completing this project and report.

We would also like to express our sincere gratitude to the UK Foreign, Commonwealth & Development Office (FCDO) for its financial support.

For the avoidance of doubt, the views expressed in this report do not necessarily reflect the views of the UK FCDO or the individuals and their organisations mentioned.

# Contents

<b>1. Executive summary .....</b>	<b>4</b>
<b>2. Introduction .....</b>	<b>5</b>
<b>Project context .....</b>	<b>5</b>
<b>Corporate interest in RE procurement .....</b>	<b>5</b>
<b>Report structure .....</b>	<b>6</b>
<b>3. Corporate RE procurement landscape in China .....</b>	<b>6</b>
<b>Available options for corporate RE procurement .....</b>	<b>6</b>
<b>Policies for renewable energy development .....</b>	<b>10</b>
<b>Estimation of demand size .....</b>	<b>14</b>
<b>Barriers to corporate RE procurement .....</b>	<b>17</b>
<b>4. Corporate RE procurement landscape in the UK .....</b>	<b>21</b>
<b>Current available options for corporate RE procurement .....</b>	<b>21</b>
<b>Key enablement policies .....</b>	<b>26</b>
<b>Key policy impacts .....</b>	<b>29</b>
<b>5. Recommendations for supporting corporate RE procurement in China .....</b>	<b>30</b>
<b>6. List of references .....</b>	<b>34</b>

# 1. Executive summary

To achieve its climate commitments for 2030 and 2060, China will continue to increase its deployment of renewable energy. The rapidly growing interest and demand for renewable electricity procurement from corporates will be a significant driver for the investment and deployment of renewable energy. With the support of the UK Foreign, Commonwealth & Development Office (FCDO), this report aims to identify the barriers and provide recommendations to scale-up renewable energy procurement in China.

With the support of a series of policies including Feed-in-Tariffs (FiTs), renewable energy development in China has substantially increased in past decades, while the costs have reduced significantly, entering a subsidy-free era. Since the launch of the green electricity trade pilot program in September 2021, direct green electricity transactions have accelerated. Following this, authorities have released several supporting policies, such as the trial transaction rules in the southern region which clarify the detailed rules, and the Implementation Plan for Promoting Green Consumption which proposes to further mobilise demand of green electricity consumption.

Currently, China's main renewable energy procurement options are direct Power Purchase Agreements (PPAs) and unbundled Energy Attribute Certificates (EACs). Key barriers include the lack of clear market rules in some regions, limited accessibility especially for inter-provincial procurement and the risk of double counting renewable attributes in different market systems. The UK experience provides some high-level insights on renewable energy development, such as the importance of driving down renewable energy costs to be more competitive through R&D support and market-pull policies.

To promote and accelerate renewable energy procurement in China, actions need to be taken to overcome the current barriers and unlock the potential for renewable electricity procurement. Below is a series of initial recommendations on how to scale up green electricity procurement:

- Develop and improve the detailed transaction rules for direct PPAs of green electricity to provide greater clarity for market players, especially retailers and buyers.
- Accelerate the transition from pilot phase to normal operation and organise transactions on a regular basis.
- Improve market accessibility and policy transparency to make it easier for corporates to procure renewable electricity, especially international companies.
- Develop the market mechanisms for inter-provincial transactions to increase the scale of inter-provincial PPAs for green electricity.
- Encourage long-term PPAs (e.g., 5-10 years) for green electricity, including exploring the current willingness of the generators and customers to sign longer contracts, analysing current barriers, and promoting pilot projects.
- Avoid double counting risks between direct PPAs, GECs, RPS and CCER by strengthening the coordination between authorities and clarifying the rules of different systems.
- Further mobilise corporates' demand for green electricity by linking this with the 'dual control' policy of energy consumption as well as the carbon trading market.
- In the medium and long-term, explore the feasibility of virtual PPAs and conduct pilot projects with the development of a spot market.
- Promote technology innovation in renewable energy and low carbon energy systems to further reduce the LCOE of renewable energy, making it more competitive than traditional thermal power.

## 2. Introduction

### Project context

Since the UK and China signed the Clean Energy Partnership in 2015, the two economies have deepened their cooperation in research and industry to support efforts to tackle climate change and provide long-term energy security, working together to transition to a low carbon energy system<sup>1</sup>. In the *UK-China Clean Energy Partnership Work Plan 2021/2022*, both countries agreed to strengthen cooperation in areas including clean energy technologies, transition pathways, power system reform and international governance and cooperation.

The UK and China have reached a consensus that cooperation on transition to a carbon-neutral energy system is the top priority for both countries. As the first global economy to enshrine its net zero commitment in law, the UK has prioritised energy transition in its industrial strategy. To achieve China's commitments of peaking carbon emissions before 2030 and carbon neutrality by 2060, the decarbonisation of the energy system has been identified as one of the key actions.

Considering the power sector's significant contribution to China's total carbon emissions, **the large-scale deployment of renewable energy in China is crucial to achieving the country's climate commitments**. According to the high-level policy framework for achieving carbon peaking and carbon neutrality<sup>2</sup>, the share of non-fossil fuels in total primary energy consumption is targeted to reach 25% by 2030 and 80% by 2060, with wind and solar generation capacities exceeding 1,200GW by 2030. Additionally, the Chinese government plans to establish a unified national power market by 2030, with renewable energy fully participating in the market on a level playing field. Corporate procurement of renewable energy can help reach these targets.

### Corporate interest in RE procurement

Corporate interest in procuring renewable energy has grown substantially over the past decade, with increased purchases becoming a significant driver of growth in the deployment of renewable energy<sup>3</sup>. Many multi-national corporations headquartered in Europe, Asia and North America have set 100% renewable energy consumption targets, while others have established smaller, but substantial goals. Global companies are purchasing renewable energy for a variety of reasons: to meet internal climate targets, access more competitive electricity prices, and demonstrate climate leadership<sup>4</sup>. In this respect, China has become a major focus area, as companies seek to increase the amount of renewable energy sourced for their own operations and their China-based supply chains. Given that China is the world's

---

<sup>1</sup> UK Government (2015a). [UK and China sign the Clean Energy Partnership](#)

<sup>2</sup> China Government (2021a). [中共中央 国务院关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见\\_中央有关文件\\_中国政府网 \(www.gov.cn\)](#)

<sup>3</sup> CRS (2019). Accelerating Corporate Renewable Energy Engagement in China

<sup>4</sup> Bird, L. et al. (2017). Policies for Enabling Corporate Sourcing of Renewable Energy Internationally: A 21st Century Power Partnership Report, National Renewable Energy Laboratory, Golden, CO

largest manufacturer—accounting for 28.7% of global manufacturing output in 2019<sup>5</sup>—there is a significant opportunity for large-scale procurement of renewable energy.

With the recent announcement of China’s pledge to peak emissions before 2030 and achieve carbon neutrality by 2060, there is also additional pressure domestically. While there are new and existing mechanisms which have enabled both domestic and overseas companies to access renewable energy, the voluntary market is still nascent, and further development is required to significantly scale up corporate procurement.

## Report structure

With support from the UK Foreign Commonwealth & Development Office (FCDO), this project aims to address the barriers to large-scale renewable energy (RE) procurement in China by identifying the key challenges, reviewing UK experiences, and providing initial policy recommendations.

This report summarises the key findings of the study and is structured as follow:

- Section 3 gives an overview of China’s corporate RE procurement landscape. It summarises the currently available options for corporate procurement, the policies that have been implemented to stimulate the renewable energy market, the barriers to uptake, and estimates the future demand size.
- Section 4 assesses the UK’s experience, looking at currently available options, key enablement policies, policy impacts as well as successes and challenges.
- Section 5 offers a set of short-term and long-term policy recommendations to support the development of corporate RE procurement in China. This is based on the barriers identified and lessons learnt from the UK.

## 3. Corporate RE procurement landscape in China

### Available options for corporate RE procurement

For corporates in China, major RE procurement options include direct Power Purchase Agreements (PPAs), purchasing unbundled Energy Attribute Certificates (EACs) domestically or internationally, direct investment, onsite distributed generation, and distributed market transactions. Corporates can create their own portfolio of green electricity with a combination of these procurement mechanisms. Further details of the five options are provided in the table below.

---

<sup>5</sup> Statista (2021). [China is the World’ Manufacturing Superpower](#)

**Table 1 Available RE procurement options for corporates in China**

RE consumption options	Description	Current situation 2022	Relevant cases
<b>Power Purchase Agreement (PPA)</b>	Electricity users can directly purchase green electricity from qualified power generators or retailers. Provincial markets are the major marketplace for PPAs.	<p>25 provinces and regions have allowed intra-provincial PPAs for renewable energy<sup>6</sup>.</p> <p>In September 2021, China officially launched the green power trade pilot program. On the first day, inter-provincial green electricity transactions totalled 7,935GWh.</p> <p>In February 2022, a set of green electricity transaction rules were released on a trial basis by the power exchange centres of five southern provinces, namely Guangdong, Guangxi, Yunnan, Guizhou and Hainan. It covers both intra- and inter-provincial PPAs.</p>	In the Green Power Trading Pilot in September 2021, Tencent signed PPAs for wind and solar energy in the southern trade market organised by China Southern Power Grid. The green electricity comes from a subsidy-free wind power project in Guangdong <sup>7</sup> .
<b>Unbundled Energy Attribute Certificate (EAC)</b>	<p><b>Green Electricity Certificates (GECs)</b></p> <p>GECs are issued by the National Information Management Centre for Renewable Energy to qualified renewable energy generator</p>	GECs have no regional or industry restrictions. Any organisation or individual can become buyer of GEC via the Information Management Platform of Renewable Energy.	The first subsidy-free GEC transaction in China took place in June 2021. During the Dialogue on International Energy Transformation 2021 event, 60 flat-rate GECs were purchased from a demonstrative PV project owned by

<sup>6</sup> RMI (2022). 企业绿色电力采购机制中国市场年度报告：2021 年进展、分析与展望

These provinces and regions are: Beijing-Tianjin-Hebei, Shanxi, Jilin, Liaoning, Heilongjiang, Shaanxi, Gansu, Qinghai, Shandong, Fujian, Zhejiang, Hubei, Hunan, Jiangxi, Jiangsu, Guangdong, Sichuan, Yunnan, Chongqing, Guizhou, Inner Mongolia, Xinjiang, Ningxia, Guangxi, Tibet

<sup>7</sup> TechWeb (2021). [首批绿电交易市场主体！腾讯数据中心积极响应国家双碳战略](#)

	companies. Each GEC has a unique electric identification code and corresponds to 1MWh of on-grid electricity powered by non-hydro renewable energy.	On the supply-side, only onshore wind and solar PV projects (excluding distributed RE generation) are eligible to participate in the GEC system.	China Power International Development Ltd <sup>8</sup> .
	<p><b>International unbundled EACs</b></p> <p>Two major types of international unbundled EACs are I-REC and APX TIGR. Both represent the environmental attributes of the generation of 1MWh of energy produced by renewable sources.</p>	<p>I-REC and APX TIGR are acknowledged by CDP, RE100 and many other international reporting frameworks. Therefore, international EACs are often considered by multinational companies' regional offices and supply chain companies located in China.</p> <p>From June 2021, only subsidy-free projects can apply and register for I-RECs in China. For projects receiving a FiT, the issuance of I-RECs will cease no later than 1 January 2023<sup>9</sup>.</p>	The largest single procurement of flat-rate international EACs in China took place in July 2021. In this transaction, one of Apple's supply chain companies in China bought 100,000 APX TIGRs from a solar project, at a price of CNY 0.025-0.03 per kWh. This is also the largest transaction of flat-rate EACs globally <sup>10</sup> .
<b>Direct investment in utility-scale project</b>	Corporate users invest in renewable projects directly on their own or through third parties. Investors either have full or partial ownership of the projects they are invested in.	No regional or industry restrictions, open to all companies.	In 2016, Apple and Goldwind co-invested in 285MW of wind projects in China, with Apple taking 30% ownership of the projects <sup>11</sup> .

<sup>8</sup> QQ News (2021). [我国首单平价绿证交易完成](#)

<sup>9</sup> IREC Standard (2021). [Change in issuance criteria for China following Consultation](#)

<sup>10</sup> Wall Street CN (2021). [100000 张！中国规模最大的平价绿证交易达成！](#)

<sup>11</sup> Sina Finance (2016). [苹果扩张在中国新能源布局：入股金风科技旗下 4 家新能源公司](#)

<p><b>Generation from installations on company premises / on-site generation</b></p>	<p>An enterprise can install distributed PV or wind power system on-site. The generated electricity can be either consumed by the enterprise or sold to the grid.</p>	<p>No regional or industry restrictions, open to all companies.</p>	<p>In 2017, JD Logistics implemented a rooftop distributed photovoltaic power generation system at Shanghai Asia No.1 Intelligent Logistics Park. The solar capacity was officially connected to the grid in 2018 and generated 2,538,000kWh of electricity in 2020<sup>12</sup>.</p>
<p><b>Distributed market transactions</b></p>	<p>Companies buy excess green power from their neighbours' small- or medium-scale renewable sources via distribution lines.</p>	<p>In 2019, a list of the first 26 distributed power trading pilot projects was approved and announced. This first batch of projects accounted for 1.65MW in total. However, not all of them have successfully proceeded to the operation phase.</p> <p>Jiangsu Province is leading in distributed market transactions. In 2019 and 2020, transaction rules and contract templates were released to facilitate the transactions in the province.</p>	<p>Among the 26 pilot projects, the first successful one was a 5MW project in Jiangsu Province. It started operations at the end of 2020. The project is expected to generate 6.8 million kWh per year via a 'solar + agricultural crops planting' mode. The power generated will be traded in the neighbouring area<sup>13</sup>.</p>

<sup>12</sup> JD.com (2020). [Environmental, Social and Governance Report](#)

<sup>13</sup> Sohu News (2021). [到 2025 年底，将达到分布式 12G 到 2025 年底，将达到分布式 12GW、集中式 14GW！江苏省“十四五”可再生能源规划征求意见稿出炉 W、集中式 14GW！江苏省“十四五”可再生能源规划征求意见稿出炉](#)

When making RE procurement decisions, corporates usually need to consider accessibility, additionality, capital investment and cost. Onsite generation will most likely be prioritised for green electricity consumption if there are no barriers to its installation e.g., inadequate roofs for solar PV. Considering the additionality and cost saving potential, PPAs are preferred by many corporates. Due to the limited access to PPAs, many companies in China have to purchase the unbundled EACs to achieve their RE consumption targets, including GECs, i-RECs and APX-TIGR. Direct investment in utility-scale projects usually requires large capital investment and expertise in the renewable energy sector, and so only leading enterprises with large electricity consumption can consider this option.

According to the statistics from RE100 in 2020, most renewable electricity consumed by RE100 members in China is sourced through unbundled EACs, followed by direct PPAs<sup>14</sup>.

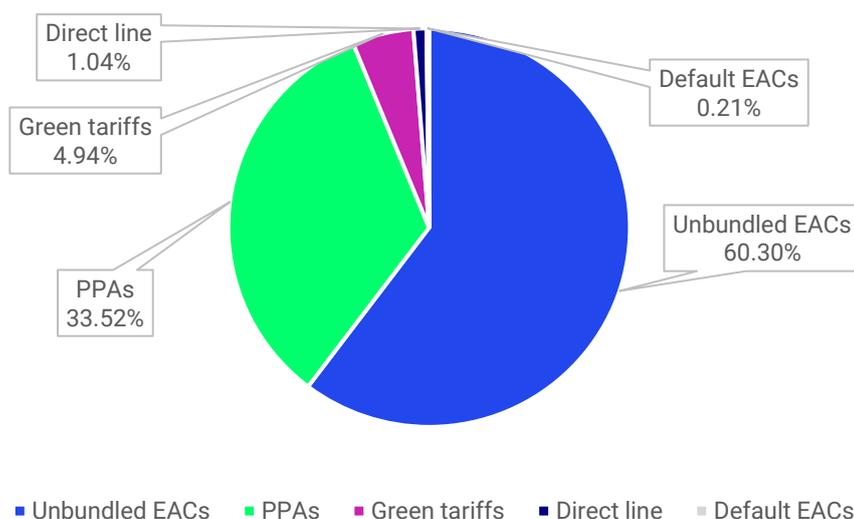


Figure 1 Sourcing of RE in China, reported by RE100 and CDP members in 2020 (RE100, 2021)

## Policies for renewable energy development

In China, many policies have been established to accelerate the development of both the RE sector and the RE trade market. Direct subsidies have played a crucial role in scaling up the sector and increasing the supply of renewable energy. For example, Feed-in Tariffs (FiTs) have boosted wind and solar capacity by around 10-fold and 100-fold respectively within one decade. However, FiTs have also raised challenges such as curtailment issues, squeezing out potential transaction opportunities, and burdening public finance. Over the last few years, policies have been implemented to optimise the pricing structure of renewable energy, reduce curtailment and increase demand, and pilot a national-level green energy trade market. According to the *14th Five-Year Plan for Modern Energy System*, China plans to increase the share of non-fossil fuels in its electricity supply to 39% by 2025, recognising the low carbon energy transition as one of the key actions in the *14th Five-Year Plan*<sup>15</sup>.

<sup>14</sup> RE100 (2022a). [Stepping up: RE100 gathers speed in challenging markets](#)

<sup>15</sup> China Government (2022a). [【关于印发《“十四五”现代能源体系规划》的通知\(发改能源〔2022〕210号\)】-国家发展和改革委员会 \(ndrc.gov.cn\)](#)

## Optimising the pricing structure

The Chinese government has used a set of policy tools to optimise the pricing structure of renewable energy to move towards a zero-subsidy era. This includes the use of auctions to decide the level of subsidies for solar and wind projects, launching subsidy-free pilot projects, and gradually phasing out subsidies.

### 1) Auctions and decreasing benchmark prices for wind and solar energy

China introduced FiT pricing mechanisms for renewable energy in 2009, which has promoted the development of the renewable energy industry over the past decade. With the increasing deployment of renewable energy and the reduction of the Levelised Cost of Electricity (LCOE) for renewable energy, the government has gradually lowered the FiTs over the years. In 2019 and 2020, the National Development and Reform Commission (NDRC) published a series of policies to improve the FiT mechanism for renewable energy. According to the new policies, the price of new wind and solar energy projects should be determined via auctions while fixed FiTs will be replaced by benchmark prices which will function as price ceilings from 2019. The following tables show the decrease of FiTs and benchmark prices for onshore wind and solar energy projects on an annual basis<sup>16, 17, 18, 19</sup>.

**Table 2 Benchmark prices (fixed FiT or auctioned under a price ceiling) for solar energy (CNY/kWh)**

	2017	2018	2019	2020
Zone 1	0.65	0.5	≤ 0.4	≤ 0.35
Zone 2	0.75	0.6	≤ 0.45	≤ 0.4
Zone 3	0.85	0.7	≤ 0.55	≤ 0.49

**Table 3 Benchmark prices (fixed FiT or auctioned under a price ceiling) for solar energy (CNY/kWh)**

	2017	2018	2019	2020
Zone 1	0.40	0.40	≤ 0.34	≤ 0.29
Zone 2	0.45	0.45	≤ 0.39	≤ 0.34
Zone 3	0.49	0.49	≤ 0.43	≤ 0.38
Zone 4	0.57	0.57	≤ 0.52	≤ 0.47

<sup>16</sup> NDRC (2016). [关于调整光伏发电陆上风电标杆上网电价的通知\(发改价格〔2016〕2729号\)](#)

<sup>17</sup> NDRC (2018). [关于2018年光伏发电有关事项的通知\(发改能源〔2018〕823号\)](#)

<sup>18</sup> NDRC (2019). [关于完善光伏发电上网电价机制有关问题的通知\(发改价格〔2019〕761号\)](#)

<sup>19</sup> NDRC (2020). [关于2020年光伏发电上网电价政策有关事项的通知\(发改价格〔2020〕511号\)](#)

## 2) Subsidy-free pilot projects

The Chinese government have begun to encourage subsidy-free pilot projects. In early 2019, the NDRC and National Energy Administration (NEA) announced *A Notice on Proactive Promotion for Subsidy-free Wind and Solar Projects Integration into the Grid*. A series of supporting measures were proposed to support the construction of subsidy-free projects. For example, local municipalities should reduce non-technical costs for low or zero-subsidy projects by adjusting land-use tax and resource transaction fees to encourage pilot projects. Another example is that grid companies should guarantee the integration of all generated electricity from subsidy-free projects. These projects are also allowed and encouraged to receive additional income through trading green electricity certificates.

## 3) Phasing out subsidies

The new milestone policy of phasing out subsidies has been implemented after lowering benchmark prices for renewable energy and piloting subsidy-free projects. In 2021, the NDRC implemented *A Notice on FiT Policy of Renewable Energy*. According to the notice, newly registered utility-scale and commercial and industrial (C&I) distributed solar projects and newly approved onshore wind power projects will not receive subsidies. Prices for these types of new projects are set to the local coal-fired power benchmark prices. In the meantime, new projects are allowed to participate in market transactions on a voluntary basis to achieve a better payoff for the environmental value of renewable energy<sup>20</sup>.

## Reducing curtailment to increase consumption for renewable energy

In May 2019, the long-awaited Renewable Portfolio Standard (RPS) policy was formally released following three rounds of comments by NDRC and NEA. Afterwards, provincial-level RPS policies and implementation plans were issued accordingly. The main objective of the RPS is to ensure minimum renewable energy consumption in provinces and to allocate the responsibilities for renewable consumption fairly among energy-intensive consumers. The RPS requests that provincial-level grid companies, retailers (load-serving entities), buyers directly participating in PPA transactions and buyers with self-supplied power plants meet a renewable electricity consumption target.

The RPS lists three ways to fulfil the obligation<sup>21</sup>:

- Consuming renewable electricity from onsite wind and solar projects or PPAs of wind and solar (where transactions are available)
- Purchasing renewable energy from other obligated parties that have exceeded their own targets
- Purchasing voluntary GECs to offset the amount of electricity obligated to them

The RPS will continue to play a crucial role in China's transition to renewable energy. According to the *Draft Document for Comments on RPS Target for 2021 and for 2022-2030*, released by the NEA in February 2021, new targets of 40% RE consumption and 25.9% non-hydro RE consumption by 2030 were proposed. This will require a 1.47% increase in non-hydro RE consumption year-on-year from 2021 to 2030<sup>22</sup>. Though the final document only announced the provincial-level targets and responsibilities for 2021 and 2022, it is expected that the targets will increase annually in order to achieve China's energy transition targets of

---

<sup>20</sup> Solarbe (2021). [2021 年新能源上网政策全面解读：不再补贴，实行平价上网](#)

<sup>21</sup> RMI (2019). *State of The Market 2019: Corporate Renewable Procurement in China*

<sup>22</sup> China Government (2021b). [国家能源局征求意见：2021-2030 年各省光伏、风电消纳责任目标 \(yq.gov.cn\)](#)

20% non-fossil fuel energy use by 2025 and 25% by 2030<sup>23</sup>. The RPS scheme will be essential in mandating renewable energy demand.

## Green power trade market

Policies released in recent years demonstrate a clear ambition from the Chinese government to establish a well-functioning and high-performing market for green electricity. High-level goals are set and published in the *Guiding Opinion on Accelerating in Building a National Power Market System*, published by the NDRC and NEA in early 2022<sup>24</sup>. A unified national power market will initially be developed in 2025, with a significant increase in the scale of green power transactions and favourable mechanisms for RE development. In 2030, the unified national power market will be established with renewable energy fully participating in market transactions on a level playing field. In the past six months, a series of policies have been released, which have accelerated the green power trade in China.

In 2021, the government approved the *Green Power Trading Pilot Work Plan* developed by the China National Grid and China Southern Grid, to establish the green power trade market in China. According to the Plan, wind and solar energy generators, consumers and retailers, and grid companies are allowed to participate in green electricity transactions. The scope of green power products mainly includes wind and solar power in the first stage. It will also extend to cover qualified hydro-powered electricity at a later date. It will be an independent product under China's existing medium and long-term power trade framework and will be organised and executed as a priority in market transactions and grid operations.

In September 2021, the green power trade pilot was launched, achieving 7.9 billion kWh in total trade volumes between 259 participants from 17 provinces in the first day. The trade pilot was organised by China Southern Power Grid and China State Grid, jointly supported by the two power exchange centres in Beijing and Guangzhou.

In February 2022, the detailed transaction rules for green power transactions (trial) were issued in five southern provinces, namely Guangdong, Guangxi, Yunnan, Guizhou and Hainan. The rules clarify that sellers of green electricity are RE generators qualified for GEC issuance, which to date have mainly been onshore wind and solar projects. The rules also mention that the range of qualified sellers would gradually be extended to include hydro and other RE generators. The buyers of green electricity are electricity users or retailers. The transaction products are green electricity bundled with GECs, with the GECs transferred from the generators to the consumers to align with the transactions.

With regards to distributed market transactions, a new policy<sup>25</sup> released by the NEA in December 2021 highlights the need to improve the market transaction mechanism and promote the participation of distributed power generation in the green electricity market. It is expected that there will be more detailed policies or implementation plans announced to accelerate the development of distributed market transactions.

---

<sup>23</sup> China Government (2021c). [国家发展改革委 国家能源局关于 2021 年可再生能源电力消纳责任权重及有关事项的通知\\_电力\\_中国政府网 \(www.gov.cn\)](http://www.gov.cn)

<sup>24</sup> China Government (2022b). [国家发展改革委 国家能源局关于加快建设全国统一电力市场体系的指导意见](http://www.gov.cn)

<sup>25</sup> China National Energy Administration (2021). [国家能源局关于印发能源领域深化“放管服”改革优化营商环境实施意见的通知 国能发法改〔2021〕63号-国家能源局网站 \(nea.gov.cn\)](http://www.nea.gov.cn)

## Potential demand for renewable energy will grow

The Chinese government have recently released a set of policies that demonstrate its commitment to increasing the demand for renewable energy. In January 2022, the NDRC, Ministry of Industry and Information Technology (MIIT) and five other bureaus announced the *Implementation Plan for Promoting Green Consumption*. In the plan, one whole section is designated to further stimulating the potential demand for green electricity at the national level. The plan encourages leading enterprises in various industries, large state-owned companies, and multinational corporates to consume green electricity. It also highlights the importance of motivating export-oriented enterprises and regions with high economic affordability to gradually increase their percentage of green electricity consumption. Besides this, it also mentions linking green electricity consumption with the carbon emission trading market.

In February 2022, the NDRC and NEA released another policy on improving the green and low carbon transformation mechanism in the energy sector, which proposes to improve the mechanism and policy systems for promoting green energy consumption<sup>26</sup>. It included improving the energy 'double control' policy to exclude new renewable energy in total energy consumption control, promoting GEC transactions and encouraging green energy consumption. This is a very clear signal to the market that demand for renewable energy will grow in the near future.

## Estimation of demand size

### RE procurement demand from RE100 commitments

Seven Chinese domestic companies have joined the RE100<sup>27</sup> initiative, two of which are no longer members<sup>28</sup>. Out of the current five RE100 members, four are green technology companies. The most recent member, Chindata, is a leading data centre solution provider, signalling interest from the IT sector—a very carbon-intensive industry—to begin decarbonisation efforts.

The table below shows the list of both current and former Chinese RE100 members, their renewable energy targets and progress made in 2019 and 2020. It is encouraging to see that existing members joined from 2019 onwards, with ambitious targets ranging from 2025 to 2040. All members have made progress in reaching these.

**Table 4 RE100 target of current Chinese members<sup>29</sup>**

Company	Sector	Joining year	RE100 target year	Interim targets	% RE 2020	% RE 2019
Chindata	IT	2021	2040	N/A	N/A	N/A

<sup>26</sup> China Government (2022c). [国家发展改革委 国家能源局关于完善能源绿色低碳转型体制机制和政策措施的意见\\_节能与资源综合利用\\_中国政府网 \(www.gov.cn\)](http://www.gov.cn)

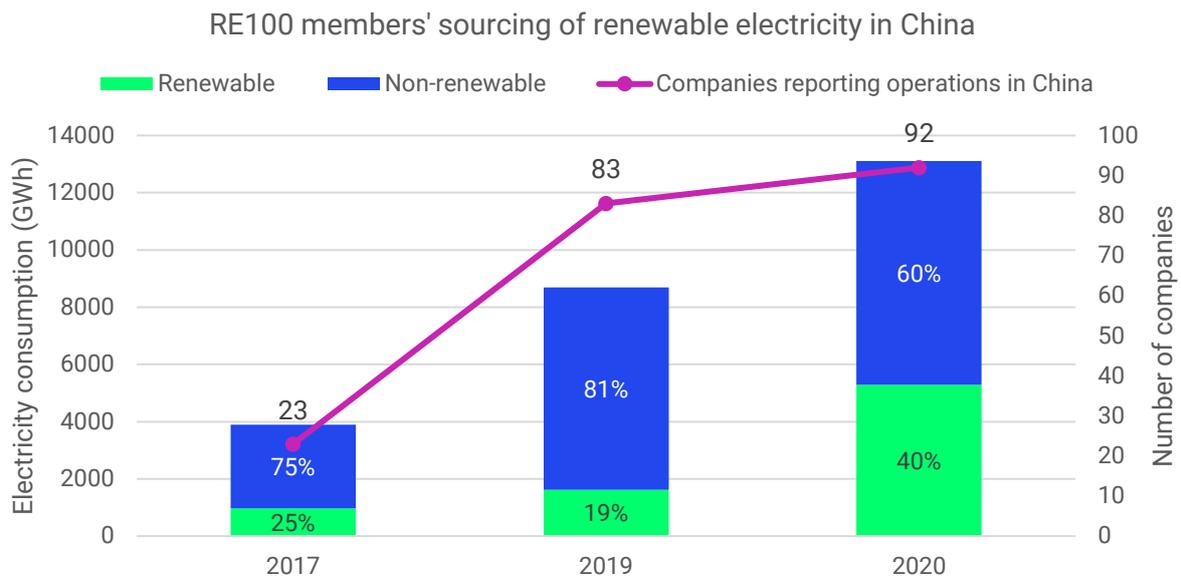
<sup>27</sup> RE100 is a global corporate initiative that brings together businesses committed to 100% renewable electricity

<sup>28</sup> Broad Group and Elion have not been listed as members in the latest RE100 Annual Report 2021. It is unclear whether they were removed due to lack of reporting in 2020 or if they have renounced their commitments.

<sup>29</sup> RE100 (2022a) Ibid.

Sungrow	Greentech	2020	2028	60% by 2025	23%	11%
LONGi	Greentech	2020	2028	70% by 2027	42%	15%
Envision Group	Greentech	2019	2025	50% by 2023	3%	3%
Jinko Solar	Greentech	2019	2025	50% by 2022 70% by 2023 85% by 2024	30%	18%

Despite the small number of domestic companies committed to RE100, many international reporting RE100 members have operations in China. With increasing pressure for multi-national corporations to address the carbon impacts of their global operations and supply chains, there is strong demand from the overseas market in procuring renewable energy in China. According to the RE100 Annual Report 2021, China is third-biggest market for sourcing renewable electricity. The chart below shows the trend in renewable energy consumption and growth of RE100 members with operations in China, including domestic companies, across 2017, 2019 and 2020 as reported by RE100 members<sup>30</sup>.



**Figure 2 RE100 members' sourcing of renewable electricity in China**

Sourcing of renewable electricity has more than tripled between 2019 and 2020, from 1,622GWh to 5,290GWh. Total consumption of electricity has also risen from 2,914GWh in 2017 to 7,816GWh in 2020. In line with this trend, RE100 members with operations in China have almost quadrupled between 2017 and 2020.

As more companies begin to take action to reduce their emissions, demand for renewable energy in China will only rise given the large number of corporate supply chain partners based in China. Bloomberg New Energy Finance analysis shows that renewable electricity demand from supply chain companies and

<sup>30</sup> RE100 data was unavailable for 2019

domestic RE100 member companies will reach at least 116,000GWh in 2030<sup>31</sup>. Meeting the renewable power procurement needs of enterprises will become a necessary requirement for China if it is to retain its supply chain companies. There is also a growing trend of Chinese corporates joining international initiatives to demonstrate their commitment to climate change. An example of this is the Science-Based Targets initiative (SBTi), where 57 companies have either set or committed to setting emissions reduction targets<sup>32</sup>. Part of this journey will include moving towards 100% renewable electricity consumption. The combination of both international and domestic demand will push China towards becoming the world's largest corporate renewable electricity trading market.

## RE procurement demand from data centres

China's IT sector has been growing at a rapid speed and has become a large consumer of electricity. In renewable electricity transactions to date, data centres play an active role in seeking and buying large volumes of green electricity. According to Bloomberg NEF, the top two clean energy buyers in China were Alibaba Cloud and ChinData, both from the data centre sector. GDS, another leading developer and operator of high-performance data centres, also committed to achieve 100% renewable energy consumption and carbon neutrality by 2030 in their ESG report in 2021.

Though the estimation of electricity demand of data centres in China varies according to different institutions and research,<sup>33,34,35</sup> they all reach a consensus that electricity demand from this sector will grow rapidly. According to Greenpeace, China's data centres consumed 150.7TWh of electricity in 2020, equivalent to 2% of China's total electricity consumption. This is projected to triple by 2035, ranging between 450.5TWh and 485.5TWh<sup>36</sup>. If data centres are to consume a minimum of 60% renewable energy in line with RE100 requirements<sup>37</sup>, total RE demand from the sector in China will reach at least 270TWh by 2035.

## RE procurement demand driven by domestic policies

Since China announced in 2020 its commitment to achieve peak emissions by 2030 and carbon neutrality by 2060, many Chinese companies have started to develop their own emissions reduction targets. Green electricity procurement will be one of the most important emissions reduction measures taken, given that electricity is the largest source of emissions for most companies.

In 2016, China implemented the Dual Control of Energy Consumption Policy to reduce energy intensity and limit total energy consumption; a key measure towards achieving its energy and climate targets. In the 2021 Central Economic Work Conference, the government proposed that new renewable energy will not be included in the total energy consumption control, with the aim of transitioning from 'double control'

---

<sup>31</sup> The Paper (2021). [On the road to carbon neutrality, multinational companies are incorporating their suppliers' carbon reduction performance into their procurement decision-making systems](#)

<sup>32</sup> SBTi (2022). [Companies Taking Action](#)

<sup>33</sup> Greenpeace (2021). 中国数字基建的脱碳之路：数据中心与 5G 减碳潜力与挑战（2020-2035）

<sup>34</sup> Greenpeace and North China Electric Power University (2020). 点亮绿色云端中国数据中心能耗与可再生能源使用潜力研究

<sup>35</sup> CDCC (2021). 2021 年中国数据中心市场报告

<sup>36</sup> Greenpeace (2021). Ibid.

<sup>37</sup> RE100 (2022b). [Technical Guidance](#)

of energy consumption to 'double control' of total carbon emissions and intensity as soon as possible. In the newly released *14th Five-Year Plan for a Modern Energy System* as well as the *Government Work Report* delivered by Premier Li Keqiang, it is mentioned again that additional renewable energy will be excluded from total energy consumption accounting<sup>38</sup>. According to the *14th Five-Year Plan on Energy Saving and Emissions Reduction*, additional usage of renewable electricity between 2021 and 2025 will not be counted under the regional total energy consumption control<sup>39</sup>. These policies will drive further demand for green electricity consumption, especially for the fast-growing enterprises in energy-intensive industries.

In the *Implementation Plan for Promoting Green Consumption* released in early 2022, the Chinese government is going to explore the connection between the carbon emissions trading system (ETS) and green electricity consumption. This means that green electricity consumption will be considered as an emissions reduction measure in the carbon market. This will provide direct motivation for companies involved in the ETS to procure green electricity. The Plan also encourages leading industrial enterprises, large state-owned companies, and multinational corporates as well as export-oriented companies to consume green electricity. As such, we can expect that demand for renewable energy from domestic companies will grow.

## Barriers to corporate RE procurement

China has been identified by RE100 members as one of the most challenging markets for achieving 100% renewable electricity in both 2020 and 2021. Despite the introduction of market reforms aimed at accelerating the development of the renewable power market and several mechanisms to improve corporate access to procure renewable electricity, **regulatory complexities, limited to no availability of supply in some regions and lack of PPAs** have been cited as key barriers in preventing corporates from realising their renewable electricity targets<sup>40</sup>.

Against the backdrop of China's pledge to achieve carbon neutrality by 2060 and global commitments from multi-national corporations to address the carbon impacts of their international operations and supply chains, there is growing interest from both overseas and domestic companies operating in China in procuring renewable energy. However, existing barriers need to be addressed first in order to create the right market conditions that would enable a significant scale-up of renewable energy investment and transactions from the private sector. This section will explore the limitations of PPAs and GECs, which are the main mechanisms for large-scale corporate procurement. It will also give a brief overview of the challenges surrounding other procurement mechanisms.

### Barriers of PPAs

Lack of PPAs has been cited as a key barrier to renewable procurement in China by RE100 members. While several new policies have been introduced to expand access to PPAs, there are still a number of regulatory complexities which have prevented large-scale uptake from corporates. Currently, most provinces in mainland China allow corporate consumers to directly sign PPAs with power generators with wind and solar assets. However, only limited provinces have normalised green electricity transactions.

---

<sup>38</sup> China Government (2022d). [2022 年李克强总理作政府工作报告\\_中国政府网 \(www.gov.cn\)](http://www.gov.cn)

<sup>39</sup> China Government (2022e). [国务院关于印发“十四五”节能减排综合工作方案的通知（国发〔2021〕33号）\\_政府信息公开专栏 \(www.gov.cn\)](http://www.gov.cn)

<sup>40</sup> RE100 (2022a). Ibid.

Although the national-level green power trade pilot launched in September 2021, only large suppliers have been involved and transactions are not organised regularly, leading to insufficient supply and limited access for corporate buyers. Currently, transactions are generally limited within a single province, and both parties must be included on the government-approved list in order to transact through the provincial power exchange. Green power trading rules also often vary between provinces, making it difficult and expensive for corporates with multiple offices and factories across several provinces to transact in, as they will need to follow different sets of local policies<sup>41</sup>.

Inter-provincial transactions are even more restricted by Chinese market rules and are typically limited to grid companies. The transaction process is usually not simple, as administrative signoffs from multiple provincial government and local power stakeholders are required. This can be extremely challenging for corporate buyers to navigate<sup>42</sup>. The limitation of inter-provincial PPAs means that renewable energy generators must be located within the province of the corporate customers' electricity load. This poses a fundamental problem as the majority of China's economically efficient renewable energy production is in the northern and western provinces, away from densely populated areas where most energy-intensive companies are located<sup>43</sup>. In the green power trading pilot, which took place in September 2021, inter-provincial transactions accounted for only 20% of total electricity.

## Challenges of GECs

China introduced the GEC system as a pilot programme in 2017 to allow businesses and individuals to purchase renewable energy voluntarily. Unlike typical EACs which are traditionally designed as an accounting mechanism to document the generation and use of renewable energy, China's GEC was developed with the primary purpose of reducing FiT subsidies. Initially, only renewable energy generators eligible for FiTs were able to issue GECs. They can either choose to sell the certificates to customers wanting to make a renewable energy claim or receive the subsidy payment. As subsidy payments can often be significantly delayed, generators may favour receiving more immediate revenues from selling GECs<sup>44</sup>. However, the market for GECs has not been very active, due to its high prices which are capped at the same rate as government subsidy payments. This represents a significant premium for corporate customers compared to electricity generated from conventional sources, with few domestic corporations in China willing to pay this additional cost for environmental attributes.

In 2019, as part of a transition away from national subsidies for wind and solar power, the Chinese government announced its plans to launch subsidy-free projects, stating that these projects could issue GECs. This has helped decouple GECs and subsidy prices, making it a more attractive option for corporates to purchase renewable energy attributes. GECs issued from subsidy-free projects are now being sold at reduced prices, reflecting corporate buyers' willingness to pay<sup>45</sup>. As of February 2022, the total number of GECs from subsidy-free projects issued is approximately five million, with around 0.94 million sold, representing around 19%, much higher than the projects with subsidy (less than 0.1% sold)<sup>46</sup>.

---

<sup>41</sup> Based on interviews with industry stakeholders

<sup>42</sup> CRS (2019). Ibid.

<sup>43</sup> Hundt and Jahnel (2021). [Decarbonisation & Power Purchase Agreements – An economic analysis of the regulatory status quo in China](#)

<sup>44</sup> Hundt and Jahnel (2021). Ibid.

<sup>45</sup> RMI (2019). Ibid.

<sup>46</sup> Greenenergy.org.cn (2022a). [Statistics](#)

Despite being feasible on a policy level, the transaction of GECs from subsidy-free projects is still a relatively new concept in the market. This is especially true given that most of these projects were only commissioned from 2021 onwards. Compared with the APX-TIGR and i-REC which are fully recognised by RE100, the GEC has no price advantage and is less recognised. As a result, many international companies looking for EACs favour i-REC and APX-TIGR. Additionally, corporates may also lack the motivation to pay the extra cost for renewable energy, reflecting the lack of pressure placed on companies to transition to 100% renewable energy from the government<sup>47</sup>.

To complicate things further, the launch of the Renewable Energy Portfolio Standard (RPS) in 2020 resulted in two types of markets for GECs: compulsory and voluntary. Under this new regulation, GECs can be used by obligated entities to fulfil compulsory targets<sup>48</sup>, alongside corporates who buy GECs to meet voluntary targets. However, the overlap of the two markets, coupled with the absence of a transparent accounting system for issuing, tracking and certifying GECs gives rise to a systematic double counting issue, raising concerns and generating uncertainty around claims on renewable attributes<sup>49</sup>. For example, when a grid company consumes a certain amount of renewable electricity to meet its RPS target, the amount that it intends to claim may already have been issued with a corresponding amount of GECs and sold to a corporate buyer. In this case, either the grid company can claim it has already consumed the renewable electricity, or the corporate buyer could make a claim on the same renewable electricity issued with GECs. This results in the same amount of renewable energy production being counted twice in the system, preventing exclusive ownership of claims on the use of renewable electricity and its attributes<sup>50</sup>.

In August 2020, CDP undertook a preliminary assessment of the GEC system against the RE100 technical criteria for acceptable procurement, in response to requests from stakeholders. The assessment confirmed that the GEC system is unable to guarantee exclusive claims by the user due to the issues of double counting of environmental attributes across GEC, GHG offsets (China Certified Emission Reduction, CCER), and other certificate systems operating in China<sup>51,52</sup>. For the GEC system to function effectively, further improvements are required to reduce the risk of double counting between the existing voluntary GEC market and the new compulsory GEC market under the RPS and the CCER. In doing so, corporate users could credibly use this mechanism to help fulfil their renewable electricity targets.

An additional complication for GECs is the existence of a different certification system for PPAs. Alongside green electricity transactions, power exchange centres can also issue Green Power Certificates or Green Power Transaction Certificates to customers. Figure 3 shows the certificate issued by the Beijing Power Exchange Centre for PPAs and the GEC. The two types of certificates issued by different organisations makes the system more complicated and confusing. It also increases the risk of double counting green attributes if the two systems are not coordinated and linked. In the newly released green electricity transaction rules for South China, GECs will be used as the certificate for consumers who

---

<sup>47</sup> Greenpeace (2021). Race to Green: Scoring Tech Companies from China, Japan and South Korea on their Climate Action and Renewable Energy Use

<sup>48</sup> RE100 (2020). [Green Electricity Certificate \(GECs\) of China](#)

<sup>49</sup> British Chamber of Commerce (2021). [British Business in China: Position Paper](#)

<sup>50</sup> Integral (2021). [Unveiling RE100 Roadmap: The Way to 100% Renewable Electricity in China](#)

<sup>51</sup> The assessment further stated that credible claims can only be made if there is ownership of all environmental attributes associated with the generation, and that none of these attributes have been sold off, transferred, or claimed elsewhere.

<sup>52</sup> RE100 (2020). Ibid.

participate in the transactions. A unique certificate should be used for green electricity transactions in different provinces alongside GECs.



Figure 3 A Green Power Certificate (left) versus a Green Electricity Certificate (right)<sup>53,54</sup>

### Limitations of other procurement mechanisms

With regards to the other mechanisms available to corporates for procuring renewable energy, each have their own respective limitations. For example, distributed market transactions are currently being piloted by the Chinese government. Despite the scheme launching in 2017, only 26 pilot projects were announced in 2019 after experiencing serious delays. To date, only one has been successful thus far<sup>55</sup>. Distributed market transactions are therefore developing slowly, which is largely due to the lack of motivation from power grids whose profits will be affected. A new policy released in early 2022 emphasises the promotion of distributed market transactions and the improvement of the transaction mechanism. It is expected that this will be accelerated later in the year. It should be noted, however, that the amount of energy that distributed projects can generate is typically too small in scale to meet the electric load of large corporations or manufacturers and can only produce 5-10% of the total<sup>56</sup>. Onsite renewable generation has a similar problem, typically generating even less than distributed projects, thus making it a challenge to fulfil 100% renewable electricity targets<sup>57</sup>.

Direct investment in renewable energy projects by corporates has been limited, and is not a popular option for those whose core business is not energy<sup>58</sup>. Barriers include the large amount of upfront capital required for investment, extensive due diligence and compliance checks needed to identify good projects,

<sup>53</sup> Zhejiang News (2021). [买下 300000000 度绿电！62 家浙企抢单国内首场绿电交易](#)

<sup>54</sup> Greenenergy.org.cn (2022b). [Honour List](#)

<sup>55</sup> British Chamber of Commerce (2021). Ibid.

<sup>56</sup> RMI (2019). Ibid.

<sup>57</sup> CRS (2019). Ibid.

<sup>58</sup> RMI (2019). Ibid.

and uncertainty on the economics and profitability of projects built in provinces with high curtailment<sup>59</sup>. It is also difficult for corporates to obtain high-quality projects as they are in direct competition with large power generation companies.

## **4. Corporate RE procurement landscape in the UK**

### **Current available options for corporate RE procurement**

Like China, the UK electricity market has multiple options for corporate procurement of renewable energy which have been enabled by UK government policy, reduced technology cost, and increased private sector demand. These options can be broadly categorised into self-generation, PPAs between generators and corporate consumers, and green tariffs backed by Renewable Energy Guarantees of Origin (REGOs) provided by a company's energy supplier.

---

<sup>59</sup> CRS (2019). Ibid.

**Table 6 Currently available RE procurement options for corporates in the UK**

RE consumption options	Description	Variations	Benefits/Pros	Risks/Cons	Current situation 2022
Direct investment for self-generation and consumption	Corporation invests in and owns the renewable energy asset primarily for self-consumption	<b>Onsite or nearby:</b> Corporate consumer owns and manages the asset; receives generated electricity behind the meter	Corporate consumer can manage and secure their own energy; high additionality; high CSR and ESG visibility; can sell excess energy to the grid with connection; leasing removes upfront capital costs; avoids grid use charges if all energy demand is covered by renewable generation	If self-owned, corporate is liable for managing risks and securing significant upfront capital investment; remaining onsite can restrict the scale of the installation	Most commercial and industrial on-site assets are solar PV installations <sup>60</sup> .
		<b>Leased:</b> Corporate consumer leases out company property to a third-party which owns and operates the on-site installation (e.g., roof-top solar), leasing it with a fixed monthly/annual leasing fee			
Corporate Power Purchase Agreement	A contractual agreement between a corporate consumer and a renewable energy generator where the corporate commits to purchasing	<b>Private wire:</b> renewable asset is owned by a renewable energy generator who sells electricity directly to the corporate consumer who is often located within a 10km radius via a private connection,	Renewable energy generators can connect to the grid and sell residual power and associated REGOs to a utility; no upfront capital investment for	Private wire PPA contract length tends to be longer-term (15-20+ years) reflecting the extra investment in the private wire connection; p/kWh offered by the	As of 2020, the UK had procured over 1,000MW of corporate PPAs <sup>62</sup> . The largest corporate PPA signed in UK was Amazon's 350MW new

<sup>60</sup> RE-Source (2020). [Introduction to Corporate Sourcing of Renewable Electricity in Europe](#)

<sup>62</sup> WindEurope (2021). [Finance and investment trends 2020](#)

<p>a specific amount of energy, or the total output of a renewable asset, at an agreed price for an agreed amount of time.</p>	<p>without connection to the grid<sup>61</sup></p>	<p>corporate consumer; fixed energy prices for both the corporate consumer and generator provide a hedge against electricity market volatility; private wire PPAs avoid grid use charges; synthetic PPAs offer significant flexibility, benefiting corporates with multiple locations as their consumption and generation do not have to occur within the same grid; all PPAs provide additionality.</p>	<p>consumer is often higher than would be offered under other PPA models because the consumer avoids addition grid use charges.</p> <p>Corporate consumers with sleeved and synthetic PPAs are still liable for all non-commodity costs associated with each unit of energy consumed and any additional supplier administrative fees.</p>	<p>offshore windfarm in Scotland<sup>63</sup>.</p> <p>PPAs originally required contracts spanning 20 years to provide sufficient security to the generator and payback period for the consumer; however, in recent years as PPA prices have fallen contract lengths have also fallen and can be as short as 5-10 years<sup>64</sup>.</p> <p>CIT sector is leading PPAs globally and within the UK<sup>65</sup>.</p> <p>Virtual PPAs are not common in the UK<sup>66</sup>.</p>
	<p><b>Sleeved:</b> An electricity supplier enters back-to-back contracts with a renewable energy generator and corporate consumer who buys the energy produced by the generator transmitted through the grid from the supplier.</p>			
	<p><b>Synthetic:</b> Often called a financial or virtual PPA; involves a financial rather than physical energy transfer. A corporate consumer and renewable energy generator agree to a strike price for an agreed period, during which the generator sells electricity to the grid and the corporate continues to buy its electricity from its normal supplier.</p>			

<sup>61</sup> RE-Source (2020). Ibid.

<sup>63</sup> OffshoreWIND.biz (2021). [Amazon Reveals Offshore Wind Play in UK | Offshore Wind](#)

<sup>64</sup> Baringa (2021). [Renewable tariffs in the UK: what makes a tariff green?](#)

<sup>65</sup> WindEurope (2021). Ibid.

<sup>66</sup> Crown Commercial Service (n.d.). [Introduction to Power Purchase Agreements](#)

Green Tariff <sup>67</sup>	Tariff offered by a licenced supplier to a corporate consumer, which specifies that some or all the energy is 'matched' by purchases of renewable energy that the supplier makes on behalf of the consumer.	<b>Investment tariff:</b> supplier uses funds from customer bills to directly invest in new renewable generation assets.	No upfront capital investment required; investment and partnership-based tariffs support additionality. All tariffs offer a simple, flexible, and relatively cheap method for renewable energy procurement; green tariffs widely available across the UK.	Certificate-backed tariffs have been criticised for greenwashing as energy provided may only be generated from non-renewable resources, while suppliers can buy unbundled EACs to inaccurately 'green up' their fuel mix; unbundled EACs do not provide additionality; purchasing GoOs does not contribute to UK decarbonisation; does not provide long-term price stability to corporate or generator	In the UK, over half of the 315 tariffs on sale in 2019 claimed some renewable energy credentials <sup>68</sup> .  In the UK, tariffs marketed as green grew from 9% in 2016 to ~50% of the market three years later <sup>69</sup> .  While the RE100 has recorded a shift away from green tariffs toward PPAs, across Europe, green tariffs and unbundled EACs accounted for 87% of green electricity products available in Europe's single market <sup>70</sup> .
		<b>Partnership tariff:</b> supplier buys power directly from multiple small-scale renewable generators helping to bring them to market.			
		<b>Certificate-backed tariff:</b> supplier buys (often) unbundled EACs—UK Renewable Energy Guarantees of Origin (REGOs) or European Guarantees of Origin (GoOs)—that are issued to renewable generators when they generate power.			

<sup>67</sup> Good Energy (2020a). [Renewable Energy Tariffs: The Problem of Greenwashing](#)

<sup>68</sup> CCC (2020) [Corporate Procurement of Renewable Energy: Implications and Considerations](#)

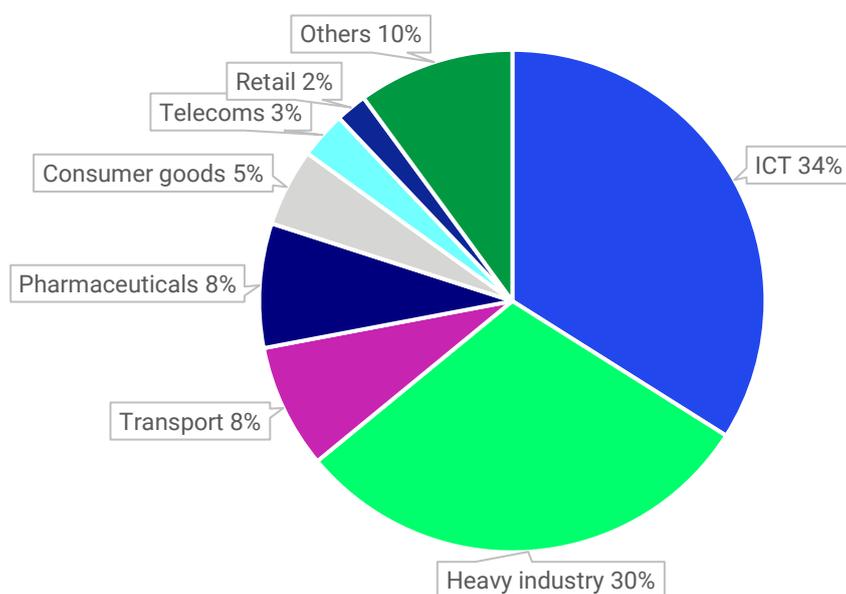
<sup>69</sup> Good Energy (2020b). [Renewable energy in Europe: An analysis of how UK energy suppliers use Guarantees of Origin certificates](#)

<sup>70</sup> RE100 (2022a). Ibid.

## Motivation of UK corporates to procure renewable energy

The private sector is increasingly turning towards renewable energy, most often via green tariffs and PPAs, to:

- **Reduce emissions and achieve net zero targets:** Across companies in the UK with a carbon reduction strategy, 39% say they are procuring renewable energy, which is the fourth most popular activity within a carbon reduction strategy<sup>71</sup>.
- **Fix and lower electricity prices:** Renewables are increasingly cheaper than fossil fuels. In 2021, UK average wholesale electricity prices more than doubled compared to the previous two years, further increasing the cost competitiveness of wind and solar, offering the benefit of long-term price certainty<sup>72</sup>. One interviewee suggested that this was particularly true for corporations with high electricity demand such as the ICT sector (e.g., Amazon, Google, Microsoft), and that large data centres have been at the forefront of corporate renewable energy procurement, primarily via private wire and virtual PPAs (Figure 4)<sup>73</sup>. It is now possible for a PPA to create cost savings from year one.
- **Corporate Social Responsibility (CSR):** As public environmental concerns grow, consumers are looking for more socially conscious businesses. Onsite generation offers corporates the opportunity to enhance their brand reputation by showcasing their commitment to reducing environmental impact. In their most recent annual report, RE100 recorded a gradual shift from unbundled EACs and tariff-based renewable energy procurement to PPAs, which are seen as more robust and offer additionality<sup>74</sup>.



**Figure 4. Cumulative renewable energy corporate PPAs by sector in Europe (MW; WindEurope, 2020)**

<sup>71</sup> CCC (2020) Ibid.

<sup>72</sup> IEA (2021) [Renewables 2021: Analysis and forecast to 2026](#)

<sup>73</sup> WindEurope (2021). Ibid.

<sup>74</sup> RE100 (2022a). Ibid. <https://www.there100.org/stepping-re100-gathers-speed-challenging-markets>

## Key enablement policies

### Overall policy framework for climate action and renewables

The UK energy market has been characterised by early liberalisation and a strong commitment to tackling climate change. The Climate Change Act 2008 was ground-breaking legislation that set the framework and a legal obligation to reduce greenhouse gas emissions in the UK. Five-year Carbon Budgets, introduced by the Climate Change Act and determined by the Climate Change Committee, set the UK's path to decarbonisation. A significant and evolving body of further legislation has provided continuous reinforcement of the UK government's commitment to addressing climate change.

The UK government has a target to reach 100% renewable electricity generation by 2035. In 2020 renewable electricity accounted for 43.1% of electricity generated<sup>75</sup>. Policies to increase the proportion of renewable energy in the grid and reduce costs have been a critical factor in incentivising their take-up by corporates.

In addition to early-stage R&D support, the UK government has used market-pull policies to incentivise investment in renewables and cost reduction. The cornerstone policy through which this has been achieved is the *Renewables Obligation and Contracts for Difference*.

### Policies supporting on-site generation

As well as setting an overall policy framework to decarbonise the energy system and support large-scale renewables feeding into the grid, the UK government also brought forward policies to support small-scale generation by corporates and bridge the cost gap between fossil fuels and renewables.

#### Non-Domestic Renewable Heat Incentive (RHI) Scheme

Established in 2011, the non-domestic RHI scheme was designed to incentivise the use of renewable heat in the non-domestic sector. It allowed businesses, the public sector and NGOs to claim quarterly payments, based on the amount of heat they generated over a 20-year period. It closed to new applicants in March 2021. Because of the local character of heat, it supported businesses to install their own renewable heat generation technologies, although heat networks fed from renewable sources were also eligible. During this time, Northern Ireland became the subject of significant controversy as it became apparent that there was no requirement for the heat generated to be used. This meant that it was possible to produce renewable heat, e.g., by burning biomass, and claiming the RHI without that heat ever being used. It was therefore known as the 'cash for ash' scandal.

#### Commercial Feed-in Tariff (FiT)

The commercial FiT was launched in 2010 and closed to new entrants in 2019. It included solar electricity (PV), wind turbines, hydroelectricity, anaerobic digesters, and micro combined heat and power (CHP) generating up to 5MW. It was split into a microgeneration scheme, for installations up to 50kW, and a scheme for large installations over 50kW and up to 5MW.

#### Smart Export Guarantee (SEG)

---

<sup>75</sup> UK BEIS (2021). [UK Energy in Brief 2021](#).

The UK government introduced the SEG in 2020 to ensure that renewable electricity generators could be paid for electricity that they export to the grid following the closure of the FiT. Eligible technologies are solar PV, onshore wind, anaerobic digestion, and hydro up to 5MW, and micro-CHP up to 50kW. Licenced energy companies with over 150,000 customers are obliged to offer a SEG tariff to those small-scale energy generators.

## Regulation of PPAs

### Private wire PPAs

The UK regulatory framework differentiates between utility-scale and distributed level generation, simplifying procedures and reducing costs for small-scale distributed generation:

- Developers are required to submit applications for installations of less than 50MW (or 100MW for offshore wind) to the relevant local authority<sup>76</sup>.
- Electricity lines above ground of 132kV are normally subject to the Planning Act 2008 and require development consent, but lines are exempt if they are under 2km long or entirely within the premises of the person responsible for their construction<sup>77</sup>.
- The Electricity Act 1989 requires consent from the Secretary of State to construct an electricity line unless it is under 20kV and will supply a single consumer<sup>78</sup>.

In addition to the policies described above, effective connection, permitting and transmission policies are critical in facilitating decentralised generation, including by corporates<sup>79</sup>.

### Sleeved PPAs

The Electricity Market Reform within the Energy Act 2013 (Chapter 6) established UK's power purchase agreement scheme to facilitate investment in electricity generation and enable access to electricity markets. It allows licenced suppliers to purchase electricity generated by independent (renewable) energy generators at a discount to the market rate<sup>80</sup>.

The Offtaker of Last Resort (OLR) scheme is designed to give generators confidence by providing a guaranteed route to market should the PPA fail<sup>81</sup>.

### Virtual PPAs

There is no specific policy or legislation that supports or incentivises virtual PPAs.

There are no geographic restrictions on where the energy is generated and, in theory, cross-border PPAs are possible. However, cross-border PPAs are not widely in use, partly due to the risk arising from a potential mismatch between energy prices in the jurisdiction where the generator is located and where the buyer is located<sup>82</sup>.

---

<sup>76</sup> Town and Country Planning Act (1990). [Town and Country Planning Act 1990 \(legislation.gov.uk\)](#)

<sup>77</sup> Planning Act (2008). [Planning Act 2008 \(legislation.gov.uk\)](#)

<sup>78</sup> Electricity Act (1989). [Electricity Act 1989 \(legislation.gov.uk\)](#)

<sup>79</sup> IRENA (2018). [Corporate Sourcing of Renewable Energy: Market and Industry Trends](#)

<sup>80</sup> Energy Act (2013). [Energy Act 2013 \(legislation.gov.uk\)](#)

<sup>81</sup> UK Government (2015b). [Power Purchase Agreement scheme: Offtaker of Last Resort](#)

<sup>82</sup> RE-Source (2020). Ibid.

## Policies on certification of renewables

The first certification scheme in the UK was introduced through the Climate Change Levy (CCL) in 2001. The CCL was a tax on UK businesses' energy bills, where businesses using renewable sources could benefit from an exemption. Ofgem, the UK energy regulator, established the *Renewables and CHP Register* where renewable energy generators reported their MWh output, in return for a Levy Exemption Certificate (LEC) which were allocated per 1MWh produced. Generators could then sell LECs to their power purchaser, who would use LECs as evidence for why their customers should be exempt from the tax<sup>83</sup>.

Because power purchasers were buying LECs directly from their energy generator, the LECs were 'bundled' and considered to drive greater additionality within the UK renewables market, compared to the subsequent REGO scheme<sup>84</sup>. The issuing of LECs ended in 2015<sup>85</sup>.

From 2009, renewable energy in the UK was certified through EACs known as REGOs, a certificate of origin, guaranteeing to the buyer that the energy certified was produced from a renewable source. One REGO equates to 1MWh of energy generated. REGOs were implemented to track renewable energy production and provide information about the proportion of electricity suppliers' source from renewable generation.

OFGEM oversee REGOs through the Renewables and CHP Register, where renewable energy generators report their MWh output in exchange for REGOs. Generators are then able to sell bundled or unbundled REGOs to suppliers which underpin green tariff products, requiring an annual Fuel Mix Disclosure (FMD). OFGEM audits suppliers' FMD and penalises non-compliance<sup>86</sup>.

Because the availability of renewables in the UK system is more than enough to meet demand, there is no scarcity of REGOs in the market, which has kept prices low. This has facilitated the growth in green tariffs in the UK, which have been offered to consumers at competitive rates with non-green tariffs. Despite the increasing demand for green tariffs and REGOs, REGOs have been criticised for lacking additionality, largely due to their ability to be 'unbundled' from the renewable energy asset.

## Current UK regulatory developments

The UK Targeted Charging Review<sup>87</sup> creates a system where everyone pays towards the network. This has removed part of the cost incentive to generate electricity behind-the-meter. However, the government is seeking to address this issue through an upcoming policy on negotiating connection costs. From 2023, costs will be agreed through negotiation between the connecting party and the system operator, who will define a cost that reflects the embedded flexibility at that connection, e.g., own generation, battery or other storage, ability to reduce demand. This will create a new form of incentive to generate electricity behind-the-meter.

---

<sup>83</sup> Ofgem (2015a). [Climate Change Levy \(CCL\) Exemption for Renewables and Renewable Energy Guarantees of Origin \(REGO\) schemes frequently asked questions](#)

<sup>84</sup> Good Energy (2020a). Ibid.

<sup>85</sup> Ofgem (2015b). [Climate Change Levy exemption removed FAQs](#)

<sup>86</sup> In 2020, Ofgem found that 20 suppliers reported to have supplied a total of 2,151,820MWh more electricity from renewable sources than was supported by the number of claimed REGOs. As a result, 18 suppliers agreed to pay a total of £90,000 into the Energy Industry Voluntary Redress Scheme (VRF). (Ofgem (2021) [Link](#))

<sup>87</sup> Ofgem (2019). [Targeted Charging Review: Decision and Impact Assessment](#)

## Key policy impacts

### **A consistent policy commitment, including early-stage R&D support followed by market-pull policies, has driven down cost and made renewables a competitive choice for corporates**

A consistent policy commitment to renewables, combined with specific key policies, has sent a strong market signal that has driven the development of renewables in the UK. Renewable technologies have seen significant cost reduction, partly as a result of market-pull policies such as the *Renewables Obligation and Contracts for Difference*, particularly in offshore wind. This has resulted in the availability of cost-competitive renewables for UK corporates, whether through on-site generation or through private wire or other PPAs with offsite generators.

Corporate PPAs (virtual or physical) with offshore wind are currently in negotiation and represent the final move away from subsidy in the UK; costs are low enough and demand for green energy is great enough that corporates will buy into PPAs with developers to guarantee offtake once a wind farm comes online.

### **Specific policies incentivised corporates to invest in on-site renewable heat and electricity, bridging the cost gap between fossil fuels and renewables**

The non-domestic RHI and commercial FiT subsidised the installation of renewable heat and electricity generation onsite. These subsidy schemes bridged the cost gap between fossil fuels and renewables and encouraged corporates to think about generating their own renewable energy onsite for the first time. Building on the experience gained through those subsidy regimes, the UK now has a well-developed market for onsite decentralised renewables with experienced installers and cost-effective technologies. While onsite generation will often be a sound commercial decision for UK corporates, protecting companies from energy price rises and volatility and providing a rapid payback and attractive returns, it should be noted that not all corporates have the physical potential, internal skills or capacity to commission on-site generation projects.

### **Certification historically supported additionality but that link was lost with the removal of the CCL**

Certification of renewables in the UK is robust, giving buyers confidence in the scheme, but the additionality created by the CCL and LECs as described above, incentivising new generation by incentivising procurement by corporates, was lost with the transition to green tariffs backed by low-cost and abundant REGOs. As described above, the unbundling of REGOs mean that an energy supplier can offer a green tariff, backed by the low-cost traded REGOs they have purchased, without making any direct investment in renewables. A renewable energy generator can claim REGOs for all the energy they generate but will not necessarily have a use for all those REGOs to prove the renewable origin of the energy. The REGOs surplus to the generator's requirements can then be sold on to suppliers to back a green tariff. This has led to significant concerns over the 'greenwashing' of green tariffs in the UK, where consumers may think they are supporting renewable energy generation, but could in fact be buying energy from a supplier using REGOs to back their green tariffs rather than buying energy from renewable sources. In 2021 the UK government has announced a review into the marketing of green tariffs to determine whether reform is necessary<sup>88</sup>.

---

<sup>88</sup> UK Government (2021). [Government to tighten rules to stop 'greenwashing' of electricity tariffs](#)

**Virtual PPAs, are attractive to corporates, have the potential to drive investment in new renewables generation, and are not dependent on policy intervention in the UK**

Virtual PPAs are attractive to both a generator and a consumer as they give both parties certainty on their cost/revenue through the agreement of a strike price. Policies to commercialise and drive down the cost of renewables in the UK, such as the RO, CfDs, non-domestic RHI and commercial FiT, have had a positive impact on the affordability of PPAs.

Virtual PPAs give flexibility over the siting of generation assets and end-users. Furthermore, they do not require intervention or subsidy by government and create additionality by incentivising the construction of new renewable energy capacity.

Due to this greater additionality, they create and a clear link with a physical asset, they also offer corporates greater environmental credibility than a green tariff.

Virtual PPAs are not yet common in the UK. Generators achieved price certainty through the RO and CfDs, and corporates were not always as motivated by green credentials and hedging energy prices as they are now. The current low cost of renewables in the UK, combined with greater incentives for corporates to lock in a source of renewable energy, mean that virtual PPAs are likely to become more common in the UK in the near-term.

**Integration costs were not addressed by policies such as CfDs and the RO; policymakers developing, or reforming incentive regimes should take account of storage integration in their design**

None of the current or historic UK policies described above addresses system integration costs. New and existing renewables capacity in the UK needs to consider potential co-location with storage in order to facilitate the continued connection of intermittent renewables to the grid. There is currently no clarity in the UK on what happens if an installation benefitting from an existing RO or CfD wants to integrate storage with their generation asset. Any new incentive mechanism under consideration should give clarity on the integration of storage in order to apportion risk appropriately, and to enable retrospective addition of storage to existing installations.

## **5. Recommendations for supporting corporate RE procurement in China**

This section introduces several initial policy recommendations for supporting and accelerating corporate RE procurement in China. Some of these recommendations can be implemented in the short-term, while others will feed into the wider power market reform and require further discussion or piloting before they can be introduced as policies or mechanisms.

In the short-term, priority should be given to improving the market accessibility and policy transparency of existing RE procurement options, especially PPAs. It is also very important to link the different mechanisms such as green electricity transactions, GECs, RPS and the carbon emissions trading market, to avoid double counting risks. In the medium and long-term, with the development of China's national power market, further renewable procurement options can be explored, such as the virtual PPA. The cost of renewables should also be further brought down through technology innovation and reduction of non-technical costs.

### **Improve and refine the transaction rules and process to increase the accessibility of green electricity**

While there has been substantial progress on green electricity transaction policy in the past half year with the launch of the green power trade pilot program and release of transaction rules in the southern region, the current policies and rules still need to be expanded on further in order to improve accessibility and reduce the complexity of transactions.

Firstly, detailed policies and transaction rules for green electricity transactions are required for the regions which operate under the China State Grid, and these need to be released as soon as possible. Though some provinces have released their own transaction rules, they often vary between provinces. It is recommended to keep the transaction rules as consistent as possible. This will, especially benefit companies with demand for RE procurement operating in multiple provinces. Secondly, the transactions should be progressed from pilot phase to normal operation as soon as possible and held on a regular basis. This could help establish a stable expectation of the market and encourage transactions to be scaled up. Thirdly, transaction rules need to be clearly explained and disclosed, making it easy for market participants to understand and follow. It is also suggested that trainings are provided for retailers and corporates with green electricity procurement demand.

To further increase the supply and availability, expanding the sources of renewable energy involved in the market is recommended. Besides utility-level solar and onshore wind projects which are major suppliers of the PPA market, new subsidy-free projects such as offshore wind and distributed solar projects, biomass and hydrogen, should also be granted qualification to participate in green electricity transactions in the near future.

### **Promote inter-provincial transactions and encourage long-term PPAs**

Transaction mechanisms for inter-provincial green electricity procurement should be developed and implemented. Considering the structural inequality of energy demand and renewable energy resources across different regions in China, inter-provincial PPAs would help to balance the demand and supply of renewable energy electricity, increasing the accessibility of renewable energy for buyers in east and southeast China and reducing the curtailment of RE in northwest China. Currently, inter-provincial PPAs are very limited in China and transactions usually only happen between the provincial grid companies in different provinces instead of between customers and generators. Further efforts are required to promote the development of the inter-provincial PPA mechanism, including how to link this with the intra-provincial markets and the spot-market.

It is also recommended to encourage long-term green electricity procurement agreements to drive RE investment from the demand side. In the UK, PPAs are typically multi-year contracts, which provide guaranteed revenue streams and thus certainty of returns for investors. While the *Green Electricity Trading Pilot Work Plan* encourages 5-10 years PPAs, most contracts are currently only one year. Long-term agreements would help both RE buyers and generators to secure long-term transaction volume and price range against uncertainty, and thus provide stability to the market. It can also help secure revenue for new projects in the new zero-subsidy era.

### **Coordinate the GEC market, green electricity transaction market, RPS system and carbon market to avoid double counting**

It is highly recommended to use the GEC as the unique certificate for green electricity consumption in China and improve the accounting system to credibly track the green attributes of renewable electricity. The power exchange centres who are responsible for organising green electricity transactions should

coordinate with the issuer of GECs (National Information Management Centre for Renewable Energy) to ensure that the GECs are transferred to the consumers and bundled with the green electricity they have purchased. In doing so, GECs can be tracked as the unique certificate for green electricity transactions across different provinces and regions.

The government should also be careful about the double counting risk between the voluntary GEC market and the mandatory market under RPS. More detailed rules or an accounting system are needed. In addition, further coordination is required during the implementation process. With regards to the carbon market, the overlap of GEC and CCER also needs to be resolved. Ideally, this would mean that renewable projects with GECs cannot apply for CCER. This will avoid double counting the green attributes of renewable energy.

In addition to the domestic market and mechanisms, there are international EACs such as iREC or APX-TIGR which are purchased by corporates looking to achieve their renewable consumption targets in China. It needs to be clear that the green electricity associated with iREC or APX-TIGR should not be eligible for GECs, so the risk of double counting can be mitigated. The suggestions made above will improve the credibility of GECs and make it fully recognised by the RE100, CDP and other international reporting systems, thus, increasing the demand for GECs.

### **Exploring the feasibility of virtual PPAs in the medium to long-term**

In the medium to long-term, it is recommended virtual PPAs should be incorporated into the current PPA scheme. In 2021, China announced six provinces and cities as the second group of electricity spot market pilots<sup>89</sup>. With the first eight pilots starting in 2017, there are now a total of 14 spot market pilots in China<sup>90</sup>. In some pilot schemes, renewable energy can be traded on the spot markets. A recently released Inter-Provincial Spot Market Trading Rules (Pilot) has expanded the geographical scope of inter-provincial transactions and encouraged corporates with RE demand and RE generators to participate in the inter-provincial electricity spot market<sup>91</sup>. The spot market development with renewables involved might enable virtual PPAs in the future<sup>92</sup>. Since a virtual PPA locks in the price of RE for buyers and secures an income stream for sellers for usually 10-20 years, both parties can hedge against market uncertainty.

### **Further incentivise corporates' demand for green power to accelerate renewable energy investment and development**

Although we have seen clear policy direction that the government will promote green electricity consumption, detailed action plans and guidance need to be released as soon as possible. For example, the methodology for GHG accounting and reporting for ETS should be revised and updated to remove the emissions reduction from green electricity consumption and to reflect the green attributes of renewable electricity in the ETS. Also, it is recommended to develop incentive policies to encourage corporates, especially large companies, to purchase green power.

---

<sup>89</sup> Sina (2021). [两部委发文：电力现货市场试点增加 6 个！新能源发电量 10%纳入市场竞争！|现货市场\\_新浪财经\\_新浪网 \(sina.com.cn\)](http://www.sina.com.cn)

<sup>90</sup> China Government (2017). [【关于开展电力现货市场建设试点工作的通知\(发改办能源〔2017〕1453号\)】-国家发展和改革委员会 \(ndrc.gov.cn\)](http://www.ndrc.gov.cn)

<sup>91</sup> State Grid (2021). [国家电网-国网四川省电力公司 \(sgcc.com.cn\)](http://www.sgcc.com.cn)

<sup>92</sup> RMI (2019). Ibid.

**Continue to bring down the cost of renewable energy through supporting technology innovation and reducing non-technical costs**

Based on the policy review of renewable energy development in China and the UK, we believe that cost reduction is key. Currently, the utility-level solar and onshore wind projects are almost comparable with thermal power in China. With the further reduction of LCOE of renewables, we expect corporates will be further incentivised to procure it, while investors will be attracted by higher revenues.

**Increase market accessibility and policy transparency for RE procurement, especially for international companies**

Finally, market accessibility and policy transparency should be improved to build international companies' confidence in achieving their renewable consumption commitments for their operations in China. If companies can meet their international obligations, this will help unlock potential foreign investment in China. To facilitate this, transaction rules should be refined and clearly explained as suggested above, with related transaction information updates such as minimum trading volumes and qualifying requirements for buyers regularly and publicly announced. Additionally, the transfer of green attributes of renewables should be tracked and disclosed transparently to align with international standards to help develop international recognition, especially for GECs. Finally, to boost the participation of buyers in the market, regular press conferences and training sessions should be organised to support companies in dealing with any challenges during the procurement process.

## 6. List of references

- Baringa (2021). [Renewable tariffs in the UK: what makes a tariff green?](#)
- Bird, L. et al. (2017). Policies for Enabling Corporate Sourcing of Renewable Energy Internationally: A 21st Century Power Partnership Report, National Renewable Energy Laboratory, Golden, CO
- British Chamber of Commerce (2021). [British Business in China: Position Paper](#)
- CCC (2020). [Corporate Procurement of Renewable Energy: Implications and Considerations](#)
- CDCC (2021). 2021 年中国数据中心市场报告
- China Government (2017). [【关于开展电力现货市场建设试点工作的通知\(发改办能源〔2017〕1453号\)】-国家发展和改革委员会 \(ndrc.gov.cn\)](#)
- China Government (2021a). [中共中央 国务院关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见\\_中央有关文件\\_中国政府网 \(www.gov.cn\)](#)
- China Government (2021b). [国家能源局征求意见：2021-2030 年各省光伏、风电消纳责任目标 \(yq.gov.cn\)](#)
- China Government (2021c). [国家发展改革委 国家能源局关于 2021 年可再生能源电力消纳责任权重及有关事项的通知\\_电力\\_中国政府网 \(www.gov.cn\)](#)
- China Government (2022a). [关于印发《“十四五”现代能源体系规划》的通知\(发改能源〔2022〕210号\)】-国家发展和改革委员会 \(ndrc.gov.cn\)](#)
- China Government (2022b). [国家发展改革委 国家能源局关于加快建设全国统一电力市场体系的指导意见](#)
- China Government (2022c). [国家发展改革委 国家能源局关于完善能源绿色低碳转型体制机制和政策措施的意见\\_节能与资源综合利用\\_中国政府网 \(www.gov.cn\)](#)
- China Government (2022d). [2022 年李克强总理作政府工作报告\\_中国政府网 \(www.gov.cn\)](#)
- China Government (2022e). [国务院关于印发“十四五”节能减排综合工作方案的通知（国发〔2021〕33号）\\_政府信息公开专栏 \(www.gov.cn\)](#)
- China National Energy Administration (2021). [国家能源局关于印发能源领域深化“放管服”改革优化营商环境实施意见的通知 国能发发改〔2021〕63 号-国家能源局网站 \(nea.gov.cn\)](#)
- Crown Commercial Service (n.d.). [Introduction to Power Purchase Agreements](#)
- CRS (2019). Accelerating Corporate Renewable Energy Engagement in China
- Electricity Act (1989). [Electricity Act 1989 \(legislation.gov.uk\)](#)
- Energy Act (2013). [Energy Act 2013 \(legislation.gov.uk\)](#)
- Good Energy (2020a). [Renewable Energy Tariffs: The Problem of Greenwashing](#)
- Good Energy (2020b). [Renewable energy in Europe: An analysis of how UK energy suppliers use Guarantees of Origin certificates](#)
- Greenenergy.org.cn (2022a). [Statistics](#)
- Greenenergy.org.cn (2022b). [Honour List](#)

Greenpeace (2021a). 中国数字基建的脱碳之路：数据中心与 5G 减碳潜力与挑战（2020-2035）

Greenpeace (2021b). Race to Green: Scoring Tech Companies from China, Japan and South Korea on their Climate Action and Renewable Energy Use

Greenpeace and North China Electric Power University (2020). 点亮绿色云端中国数据中心能耗与可再生能源使用潜力研究

Hundt and Jahnel (2021). [Decarbonisation & Power Purchase Agreements – An economic analysis of the regulatory status quo in China](#)

IEA (2021). [Renewables 2021: Analysis and forecast to 2026](#)

Integral (2021). [Unveiling RE100 Roadmap: The Way to 100% Renewable Electricity in China](#)

IREC Standard (2021). [Change in issuance criteria for China following Consultation](#)

IRENA (2018). [Corporate Sourcing of Renewable Energy: Market and Industry Trends](#)

JD.com (2020). [Environmental, Social and Governance Report](#)

NDRC (2016). [关于调整光伏发电陆上风电标杆上网电价的通知\(发改价格〔2016〕2729号\)](#)

NDRC (2018). [关于2018年光伏发电有关事项的通知\(发改能源〔2018〕823号\)](#)

NDRC (2019). [关于完善光伏发电上网电价机制有关问题的通知\(发改价格〔2019〕761号\)](#)

NDRC (2020). [关于2020年光伏发电上网电价政策有关事项的通知\(发改价格〔2020〕511号\)](#)

OffshoreWIND.biz (2021). [Amazon Reveals Offshore Wind Play in UK | Offshore Wind](#)

Ofgem (2015a). [Climate Change Levy \(CCL\) Exemption for Renewables and Renewable Energy Guarantees of Origin \(REGO\) schemes frequently asked questions](#)

Ofgem (2015b). [Climate Change Levy exemption removed FAQs](#)

Ofgem (2019). [Targeted Charging Review: Decision and Impact Assessment](#)

Planning Act (2008). [Planning Act 2008 \(legislation.gov.uk\)](#)

QQ News (2021). [我国首单平价绿证交易完成](#)

RE-Source (2020). [Introduction to Corporate Sourcing of Renewable Electricity in Europe](#)

RE100 (2020). [Green Electricity Certificate \(GECs\) of China](#)

RE100 (2022a). [Stepping up: RE100 gathers speed in challenging markets](#)

RE100 (2022b). [Technical Guidance](#)

RMI (2019). State of The Market 2019: Corporate Renewable Procurement in China

RMI (2022). 企业绿色电力采购机制中国市场年度报告：2021年进展、分析与展望

Sina Finance (2016). [苹果扩张在中国新能源布局：入股金风科技旗下4家新能源公司](#)

Sina (2021). [两部委发文：电力现货市场试点增加6个！新能源发电量10%纳入市场竞争！|现货市场\\_新浪财经\\_新浪网 \(sina.com.cn\)](#)

Sohu News (2021). [到 2025 年底，将达到分布式 12G 到 2025 年底，将达到分布式 12GW、集中式 14GW! 江苏省“十四五”可再生能源规划征求意见稿出炉 W、集中式 14GW! 江苏省“十四五”可再生能源规划征求意见稿出炉](#)

SBTi (2022). [Companies Taking Action](#)

Solarbe (2021). [2021 年新能源上网政策全面解读：不再补贴，实行平价上网](#)

State Grid (2021). [国家电网-国网四川省电力公司 \(sgcc.com.cn\)](#)

Statista (2021). [China is the World' Manufacturing Superpower](#)

TechWeb (2021). [首批绿电交易市场主体！腾讯数据中心积极响应国家双碳战略](#)

The Paper (2021). [On the road to carbon neutrality, multinational companies are incorporating their suppliers' carbon reduction performance into their procurement decision-making systems](#)

Town and Country Planning Act (1990). [Town and Country Planning Act 1990 \(legislation.gov.uk\)](#)

UK BEIS (2021). [UK Energy in Brief 2021.](#)

UK Government (2015a) [UK and China sign the Clean Energy Partnership](#)

UK Government (2015b). [Power Purchase Agreement scheme: Offtaker of Last Resort](#)

UK Government (2021). [Government to tighten rules to stop 'greenwashing' of electricity tariffs](#)

Wall Street CN (2021). [100000 张！中国规模最大的平价绿证交易达成!](#)

WindEurope (2021). [Finance and investment trends 2020](#)

Zhejiang News (2021). [买下 300000000 度绿电！62 家浙企抢单国内首场绿电交易](#)

[carbontrust.com](https://carbontrust.com)

**+44 (0) 20 7170 7000**

Whilst reasonable steps have been taken to ensure that the information contained within this publication is correct, the authors, the Carbon Trust, its agents, contractors and sub-contractors give no warranty and make no representation as to its accuracy and accept no liability for any errors or omissions. Any trademarks, service marks or logos used in this publication, and copyright in it, are the property of the Carbon Trust. Nothing in this publication shall be construed as granting any licence or right to use or reproduce any of the trademarks, service marks, logos, copyright or any proprietary information in any way without the Carbon Trust's prior written permission. The Carbon Trust enforces infringements of its intellectual property rights to the full extent permitted by law.

The Carbon Trust is a company limited by guarantee and registered in England and Wales under Company number 4190230 with its Registered Office at: 4th Floor, Dorset House, 27-45 Stamford Street, London SE1 9NT.

© The Carbon Trust 2022. All rights reserved.

Published in the UK: 2022